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COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS

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EXTENSION WORK IN ENTOMOLOGY, 1923

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Up to the time that county agricultural agents were a recognized factor in the agricultural organization of this country, there was no official channel through which the officer responsible for recommendations on the control of injurious insects could promulgate this work in an effective manner. The State and station entomologists had to depend very largely upon their own individual efforts; and as the appropriations for insect-pest control were then very small, the number of farmers and others reached was small. The popular bulletin was the main avenue of communication; and though this type of publication still holds a major place in the publicity work in entomology, it is sinking to a secondary place as a means of introducing a general entomological practice into a region. The average farmer has neither time nor inclination to read bulletins during the working season. He does not index such material; and if he saves it he soon has a cumbersome, unwieldy collection of publications, through which he will rarely attempt to search for immediate advice. With the advent of the county agents the machinery was set up in at least a part of the counties through which the information at hand on the control of pests could be disseminated with much better results. On a single entomological project in one of the Rocky Mountain States over 5,000 farmers cooperated with the county agents during the summer of 1921, and many times this number are cooperating in some of the Middle Western and Eastern States on such projects as Hessian fly and deciduous-fruit insects.

The first concern of an extension entomologist should be to establish his contacts and outline the scope, object, and general procedure of his work. His second concern should be the preparation of a clear, concise program of work. An extension entomologist, in preparing his program of work, has two important criteria in deciding upon the entomological features which need immediate extension. One criterion is the insect pests known to be of greatest economic importance in the State. These are usually ascertained from the correspondence records of the station entomologist who is usually so thoroughly conversant with these problems that his recommendations should be considered final. The Federal Insect Pest Survey, conducted as a cooperative project between the Federal Bureau of Entomology and the entomological agencies of the several States, is also in a position to give valuable information along this line. This criterion is the one most usually accepted by the extension entomologist and, in most cases, is the advisable policy in putting on extension projects; however, the relation of entomology to the productive lines or work being promulgated in the State through other specialists associated with the extension service should be given serious consideration. The projects being carried on most extensively can easily be ascertained from the annual reports and program of work of the extension

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director. However, the most effective way to line up such projects is by conference with the specialists in the productive lines. An hypothetical example might serve to illustrate this method of procedure; the dairy industry is assumed to be the important agricultural occupation of the State. A project for better sires, a project for accredited herds, a cow-testing project, and a number of projects on forage and feed crops have already been well launched in the several counties of the State. The extension entomologist consults the entomologist of the experiment station and ascertains that ox warble and horn flies are very serious cattle pests in the State. He then consults the animal-husbandry specialist and outlines a program for extension work in the control of ox warble and horn flies to be intimately associated with the other dairy projects in the several counties of the State. The complete program, including the crop production, herd management, testing, and other productive projects, accompanied by the project on pest control, is sent to the county agents in the several counties where work is already going on. In this way, the county agent feels that the insect work is an integral part of the major projects which he has under way, and the work in pest control can be made incidental to the travel necessary in carrying on these major projects.

In another case we assume that in part of the counties of the State deciduous fruit is a commercial crop. Projects are already under way for pruning, fertilization, and general orchard spraying under the direction of the horticultural specialist of the extension service. The extension entomologist ascertains from the station entomologist that codling moth is the most important insect pest in the State. He consults the plant pathologist and together they arrange a spray calendar to cover the important insect pests, particularly the codling moth, and plant diseases of the State. This calendar is taken to the horticulturist, who suggests certain changes necessary to the pomological practices of the region. The complete deciduous-fruit program, including spraying, is then sent to the county agents. Similar projects could be worked out for practically all the important pests; and by tying insect-control work to crop-production activities already under way in the county, the entomologist's work is put in its correct position in the minds of the county agent and producer.

To stage an entomological campaign against an insect pest of a crop or animal upon which the county agent is devoting little or no time is misdirected effort. The extension entomologist is placed in the embarrassing position of finding his constituency much more interested in some other crop than that upon which the insect pest is working. He embarrasses the county agent by requiring him to take up a new activity foreign to the work he has in hand. The results of the entomologist's efforts are often lost in the results of production campaigns. On the other hand, if he has his project closely associated with the productive campaigns of the county, the county agent, the farmers, and the other specialists in the extension department are all interested in obtaining definite figures on the results of the several demonstrations; and the check plats for insect-control work are outstanding demonstrations, regardless of which specialist happens to be working in the immediate locality in which the insect-control work is being carried on.

In order to deal successfully with a widespread outbreak of an injurious insect concerted community action is necessary. This can be obtained only with proper organization, effective leadership, and adequate financial backing. Lacking any one of these things, a large outbreak can not be handled. In several of the States legislative action has been taken to handle such matters, often with considerable success. However, the extension entomologist should refrain from entering into any activity which appears regulatory in any sense whatever. The agricultural public does not like to be coerced, and as soon as the extension worker assumes the attitude of the police he loses that personal contact and sympathy which is so essential to successful work.

Among the outstanding features of extension work during 1923, the Hessian-fly work, the orchard insect-control work, and the boll-weevil work are the most striking.

The Hessian fly work is extremely well organized in Ohio, Illinois, Indiana, Iowa, Nebraska, and Kansas. In the States east of the Mississippi River, especially in the northern portions of these States where wheat is seeded to grass, the average fly-free date is often so late as to make the timothy seeding very hazardous and to result in serious winter killing of the wheat itself. This average fly-free date, however, in many years runs from several days to over a week later than the actual fly-free date that year. To meet this condition and allow farmers to plant wheat as early as is consistent with safety from Hessian-fly infestation, the extension entomologists and station entomologists have organized a special Hessian-fly service. The first feature of this service is the Hessian-fly survey. The entomologist and his assistants, cooperating with the Federal entomologists located in the several States, cover as fully as possible the wheat region of the State making actual count of Hessian-fly infestation. This serves to locate the region where Hessian-fly damage may be logically expected and gives an index of the degree of infestation that early planted wheat will suffer. The second feature of the work is the establishment of observation points scattered broadly over the wheat belt of each State. These observation points usually consist of trap cages in which infested wheat stubble or wheat plants are placed. Daily observations during the period when Hessian-fly emergence is to be expected fix very accurately the date of emergence. Counts of eggs on trap crops planted nearby give a definite index of the period of egg laying. With this information in hand the entomologist can recommend very accurately the safe date to sow wheat at any given place in the State. This information is relayed through the county agents, community project leaders, and by other means, including posters and newspaper articles and, in some States has caused the planting of over 95 per cent of the wheat after the advised fly-free date. Prior to these campaigns over 80 per cent of the wheat was planted before the fly-free date. Considerable difficulty has been met in this campaign as it has introduced a number of very objectionable features in farm practice.

In some sections the sowing of wheat after the fly-free date conflicts with the filling of silos, and in a dairy section this is a paramount issue. However, the adjustment of farm practice has been most encouraging.

The entomological extension work in connection with deciduous-fruit spraying is remarkably well organized in New York and Maryland. This work is centered around the idea of a spray information service and has met with increased success for the past few years. The work has been so successful in New York that where it was found necessary, on account of the lack of funds, for the State to discontinue the work, it has been taken over by the growers themselves. The basic principle of this work is the locating of an entomological observer and advisor in the fruit-growing counties during the growing season. This man watches the developments of the various insects, and, in some cases, fungus diseases and advises the grower of the exact time to spray to obtain the best results. The Weather Bureau has detailed a special forecaster to prepare and dispatch special forecasts to each county maintaining the spray information service. In New York, the special forecaster is located at Ithaca. The field assistant is constantly in the field observing the seasonal advancement of the trees, the development of the insects, and the prevalence of disease. He is also in close touch with the entomologist and the plant pathologist of the experiment station and has available all information in regard to the problems. He receives each night the special forecast from the Weather Bureau, especially adapted to the needs of the service. With full knowledge of spraying practices in the field and with first-hand information as to field conditions, he issues from time to time as needed, recommendations for spraying different kinds of fruit. These are sent out over a telephone relay system. In one county over 800 growers were given such advice over the telephone.

In some counties where the spray information service is made to cover truck growing, a rather unique way of preparing for this type of work was taken up in connection with a series of meetings held in conjunction with local cooperative fruit growers association. Here it was clearly shown that the counties without this service were producing a relatively low percentage of A-grade fruit. These meetings were so successful that spray information services were instituted in several counties as a direct result.

In Maryland the spray-service work is built up around certain key orchards which are located broadly over the region. In these orchards observations on the development of the insects and diseases are made at intervals. Here also 24-hour weather forecasts are made for the immediate section.

An interesting fruit-insect program is being carried out in Pennsylvania, the entomologist devoting most of his attention to the farm orchard. In this State the home orchard is a very important factor in farm economics. In one of the demonstration orchards consisting of 105 trees of which 80 were of bearing age, the average annual yield for the 10-year period prior to 1923 was 400 bushels, and the average annual income for this period amounted to about \$250. During 1923, with improved methods of handling the home orchard, particularly spraying, the yield was increased to 700 bushels with an income of about \$600. The spraying cost amounted to \$152, leaving a net income over the 10-year average of over \$200. The spraying seems to be producing results under these home-orchard conditions. One spraying outfit was placed in a community in the spring of 1920. In 1921, 3 additional outfits were purchased. In 1922 the work was extended into 5 other communities where 6 sprayers were operated, and during the past year 7 machines were added to the list of machines in operation. During this year 17 power sprayers were operated in 12 communities, 12 of which are standard orchard outfits. These machines operate in 98 orchards. In 1922, 5 growers harvested 22,000 bushels of apples which gave a net return of \$13,900. In 1923 the same men harvested 22,000 bushels which are being sold at an average price well above that of last year.

The extension work on the control of the cotton-boll weevil is largely the immediate outcome of the recently devised and apparently very efficient methods for the control of this pest. The extension work is still rather weakly organized for the control of the cotton-boll weevil, though the publicity end of the practice is being handled most admirably and the interest throughout the Cotton Belt is intense. Carried on the crest of this enthusiasm very substantial areas are being treated for the control of this most serious pest. The conflicting opinions as to the relative value of the two outstanding control measures are somewhat embarrassing the work. The investigational work, however, is going on rapidly and will soon serve this end of the problem; and with a better organization of the actual extension work, the outlook is most hopeful for cotton-boll weevil control.

The outstanding features in extension entomology in the several States are as follows:

Alabama.— In Alabama the entomologist gives half his time to extension work without further assistance except from a bee specialist during a few weeks in the spring season. The principal work was control of the cotton-boll weevil, with the control of the Mexican bean beetle of second importance. The work of getting approved methods of boll-weevil control adopted has consisted largely of meetings and addresses and of the organization of communities in several of the counties. It is estimated that at least three times as much boll-weevil control was accomplished in 1923 as has ever been accomplished in any preceding year in the State. About 7 per cent of the cotton acreage, approximately 200,000 acres, received some special boll-weevil control work during the past season.

Idaho. - The extension work in Idaho lapsed materially during the past year. The alfalfa-weevil work was practically discontinued with the exception of scouting. Grasshopper work consisted of a few demonstrations. The sugar-beet webworm was so insignificant that no work was done along this line. This is largely due to changes in personnel.

Iowa. - The principal project carried on in Iowa during the fiscal year 1924 was the control of the Hessian fly. The unusual success stimulated increased interest on the part of the farmers; in one county the farmers estimated a saving of \$150,000 in 1922. One feature of this work is a series of observation stations during the period of fly emergence. These stations are scattered broadly across the wheat belt. At each station there is a specialist on duty all the time who makes daily reports on the number of flies emerging from the Hessian-fly eggs, as well as the number of fly eggs deposited on 100 marked plants in the early seeded trap coop. By this method it is possible to determine accurately the time at which wheat can be sown without danger from the Hessian fly. Reports from these stations are broadcasted through the extension system and as soon as the fly-free date is reached it is immediately telegraphed to all counties in that territory. The farmers are very rapidly coming to rely upon the recommendations of the stations. In 1922, 62.2 per cent of the farmers were following the recommendations of the extension entomologists in wheat sowing; in 1923 this increased to 90.3 per cent.

Kansas. - The chief entomological activities in Kansas during the past fiscal year were the Hessian fly, chinch bug, codling moth, and the Colorado potato beetle. One of the most interesting features of the work in this State is the boy and girl club work and the contest held in connection with this work. Here, six or seven subjects are offered to the clubs from which the members select one. Each club should have at least three members working on the same contest, the members keeping records of the various stages of the insect as observed on the plant, the way the insects attack the plant (or animal), and the control measures applied with the results obtained. These reports are made on the 1st of October on regular forms furnished by the extension entomologist. A general plan of instructions for the year's work is given to each member according to the contest he enters. Aside from actually applying the control measures, the members prepare an exhibit of the various stages of the insects, specimens of the plants attacked, and the insecticides and other material used for control. At the end of the season the awards are based on the type of collection the member made and the story of the piece of work he carried on. Thirty-eight vocational agricultural teachers are teaching entomology to their agricultural classes and the normal training classes in the schools. There are also 838 high schools teaching biology, a large number of which are emphasizing entomology. The extension entomologist has used the schools for teaching the basic principle of insect control.

Maryland. - The work in Maryland has been very largely confined to codling

moth work in the western part of the State and also in the peach section on the Eastern shore, pea-aphid work in the trucking section of Dorchester County, and general truck spraying work. The most striking feature of the work in Maryland is the spray service carried on in the western apple section and eastern peach section. Certain key orchards are selected over the region where observations on development of the insect and diseases are made at intervals. In conjunction with this work a 24-hour weather forecast is made for the immediate section. The service continues throughout the season up until the last codling-moth spray is applied, with the advice based on the examinations of material from the key orchards and the time of application, and the type of spray is very accurately determined and recommended. This information is sent out through the county agents and the community leaders. In addition, the new leader of the State horticultural society publishes the time of the advice. Demonstration orchards were conducted as in previous years. These demonstrations in many cases are combined projects with the plant pathologist. Pea-aphid demonstration work was combined with investigational work on the use of nicotine dust. In this work 22 acres of cruciferous crops and 157 acres of melons were dusted with State machines at an estimated saving of at least \$35,000 on the melons alone.

Michigan. - The European corn borer was located by Federal authorities in Monroe County in 1921. It has since spread to all the townships in this county with the exception of three and has been located in two townships in Wayne County. Personal visits were made by the extension entomologist to growers in these counties, explaining the nature of damage that could be anticipated from the corn borer and the reasons for quarantine, thus removing considerable opposition to the regulatory work.

During the winter months lectures on insects were given high schools and granges, the lectures being given under auspices of the agricultural teachers in the high schools and of county agents. These are given in the form of so-called chalk talks where the blackboard is used in place of the stereopticon. The farmers are encouraged to bring up questions of local interest at these meetings, establishing close touch between the extension entomologist and the grower.

A tour was conducted in the Upper Peninsula. On this tour many talks on insects affecting potatoes and their control were given.

Missouri. - The work in Missouri centered around three main projects: Chinch bug, Hessian fly, and San Jose scale. Each project was put in charge of a local community or school-district leader, who was directly responsible for the demonstration under the immediate supervision of the county agent. The Hessian-fly work consisted largely of an attempt to put through a late planting program. The project was not as successful as was anticipated, as the farmers are not thoroughly convinced that the damage done by the Hessian fly can be controlled in this way. However, the work of the past year and the extensive losses occasioned by the Hessian fly have been a strong lesson. The chinch-bug project was much more successful. A very excellent demonstration was carried on in Ray County. The county agent organized the southern

half of the county last fall, laying the country out into natural districts with leaders appointed to supervise the burning of hibernating quarters. Parties were organized, and burning was done by sections. During the past summer but few chinch bugs were seen in this part of the county; while in the northern half of the county, where no burning was carried on, the pest was very numerous and did considerable damage. In the whole State approximately 170,000 acres were burned over for chinch bug while over 3,000 miles of fence rows and roadsides were burned. In the region where the burning campaign was not successfully carried on over 4,000 gallons of creosote were used as a barrier to control this pest, barriers extending nearly 600 miles. In addition to this approximately 3,000 pounds of calcium cyanide were used. The third project, spraying for the control of the San Jose scale, consisted of locating demonstration orchards in eight counties, which were distributed over the fruit growing sections of the State. In these demonstration orchards the lubricating oil emulsions were used with considerable success. In all, approximately 130,000 trees were sprayed, using over 400,000 gallons of spray material, and the work resulted in the purchase of 142 spraying machines.

New York.- The most striking phase of the work in this State has been the spray information service previously referred to, which has met with increasing success for the past few years and is continued as a subproject, owing to the persistent demand of the growers. In fact, the work has been so successful that where it has been necessary, on account of lack of funds, for the State to discontinue the work it has been taken over by the growers themselves. The basic principle of this work is the locating of a permanent entomological observer and advisor in the fruit growing counties during the growing season. This man watches the development of the various insects and, in some cases, fungus diseases and advises the grower of the exact time to spray to obtain the best results. The Weather Bureau has detailed a special forecaster, located at Ithaca, to prepare and dispatch special forecasts to each county maintaining the spray information service. The field assistant is constantly in the field observing the seasonal advancement of the trees, the development of insects, and the prevalence of diseases. He is also in close touch with the entomologist and the plant pathologist of the experiment station and has available all information in regard to the problems. He receives each night a special forecast from the Weather Bureau, especially adapted to the needs of the service. With full knowledge of spraying practices in the field and with first-hand information as to field conditions, he issues, from time to time as needed, recommendations for spraying the different kinds of fruit. These are sent out through a telephone relay system. In one county over 800 growers were given such advices over the telephone.

In some counties this work also covers truck growing as well as fruit. During the winter considerable time is given to meetings in the fruit counties where all phases of the insect-control work are discussed in such a way as to aid the field assistants and the spray service during the growing season. It is quite important that the growers understand thoroughly the functions and operations of the special field assistant's work in order that they may make the most of it. A rather unique way of preparing a program where work was particularly needed was taken up this year when a series of meetings was held with the local cooperative fruit growers association and the need for the service was indicated by the relatively low percentage of A-grade fruit. These meetings were so successful that spray information services were instituted in two new counties, and much more apparatus was bought in counties where the service was not fully developed.

In order that definite information as to the prevalence of the Hessian fly may be made available, a survey of the wheat section is made just before harvest. By means of this information the amount of infestation is determined, and a report is then issued with recommendations as to sowing after the fly-free date. It is a common practice in this State to sow grass seed with wheat, and the usual fly-free date is hazardously late to sow timothy. It is, therefore, felt advisable to recommend sowing only after the fly-free date when the survey indicates a very high percentage of Hessian-fly infestation. The results of the survey are sent to the county agents in time for publication in the Farm Bureau News before sowing time. As a result, many more farmers sow after the fly-free date than would otherwise do so. The survey of 1923 showed that there was a very heavy infestation in wheat in the wheat growing sections south of Lake Ontario. These counties were notified of the situation last August.

North Carolina. - The work in North Carolina was largely concentrated on the boll-weevil control. During January, February, and March meetings were held in 28 cotton-growing counties. During early April the extension entomologist located in the cotton belt and procured the assistance of a temporary helper. The extension entomologist, by keeping in close touch with the weather conditions, advised against dusting in many cases where the heat and dry weather were sufficient to control the weevil, thereby saving the farmers a great deal in both labor and materials. The second assistant was placed in another part of the cotton belt to supplement the work of the extension entomologist. The work of the extension department was materially augmented by commercial chemical concerns who placed demonstrators in the field and who recommended the practices advised by the experiment station. On the average, the yield of cotton was good during the past season. This, however, was largely due to very favorable weather conditions.

Ohio. - The principal lines of work carried on during the fiscal year 1924 were cereal-insect control, potato spraying, orchard and vineyard spraying, and the use of paradichlorobenzene for the peach-tree borer, as well as an educational campaign being put on for the control of the European corn borer. An annual wheat-insect survey is conducted by the entomologists of Ohio, and the status of chinch-bug infestation and Hessian-fly distribution is ascertained in outlining the work for the succeeding year. This survey pointed out a small group of counties in northeastern Ohio where Hessian-fly control work would be necessary.

The potato-spraying work demonstrations in 1922 placed this subject as second in importance in the State. Nearly all the growers who had started the potato spraying work were anxious to continue the work. The work was so successful that it was difficult to get the demonstrators to leave unsprayed check roads in the fields. The orchard spraying work included spray-management programs for a few home orchards, supervision of the midsummer spraying for commercial areas, and demonstrations with the new oil emulsions for the control of San Jose scale. The paradichlorobenzene method for control of the peach borer has been eagerly taken up by the growers on account of its effectiveness and economy.

The European-corn-borer project was started because of its future importance to the corn crop of Ohio and the Middle West; in this project there is but little hope of any measurable results within the next few years.

The outstanding feature of the work in Ohio is that the subject matter is given out entirely through the county extension agent and as far as possible through project leaders, or such other organizations present in the county as will bring about the desired results. In some cases the extension specialist meets with these project leaders, giving them a thorough drilling in the subject matter of the project, after which the project leaders are looked upon by the extension service as advisors in all cases pertaining to the best success of the project within the township. The results of the Hessian-fly control work have been to retain the changed practices in nearly all the wheat growing counties in Ohio. The work has been so successful that in many counties in the western half of the State it is difficult to find early-sown wheat fields. The counties in northeastern Ohio are considerably more difficult to convert; as on the heavily clay soil wheat, when planted late, is very likely to be killed out during the winter and there is a conflict in labor between wheat sowing and silo filling, the practice being to seed the wheat before filling the silos.

Extension work with the European corn borer was concentrated in Ashtabula County where sufficient corn borer had developed to justify an effort at control. The specialist and county agent, with the cooperation of the Bureau of Entomology, conducted a campaign for burning surplus and unconsumed corn stalks and sweet-corn stubble during the last week in April. During this campaign daily articles were placed in the local papers, each of the men announcing the date of the corn-borer burning work and another

phase of the corn-borer damage as related to Ohio conditions. In addition, these articles were supported by editorials and statements in farm papers. The specialist and county agent appeared at schools and talked before 3,600 children, explaining the duties of each individual and family. Farm-bureau and community meetings were held where moving pictures or lantern slides were shown illustrating the work of the insect. Every motion-picture house ran slides advertising the burning campaign, the slides being furnished by the extension agent. Enlarged pictures and exhibits of infested material were displayed on the streets of three of the principal towns within the area during the week of the campaign. Five Federal extension workers in their own cars, each covering a district of the county, visited farms and pointed out where clean-up was needed. These men carried a supply of small leaflets bearing a picture of the corn-borer damage and facts about the necessity for clean-up by burning crop remnants. One of these leaflets was left at each farm home and as a result of this campaign it is estimated that 80 per cent of all surplus corn stalks was destroyed. Though the infestation in the county is greater than during the previous year, the campaign materially reduced the number of insects that would normally have developed. In the county to the west, where no campaign was carried on, the infestation is one and one-half times as great as that now present in Ashtabula County.

Oklahoma. - The principal projects carried on in this State were for the control of the boll weevil, the chinch bug and the green bug. In the boll-weevil work teams were organized under community leaders to burn out hibernating quarters, the county agent supervising the county units. Railroad officials cooperated in burning the rights of way. The destruction of hibernating quarters, together with the weather conditions, very materially reduced the old overwintering brood of weevils to below 1 per cent in some cases. The percentage of infestation was determined by hibernating cages located in five different places. Each cage contained 500 weevils. These cages were also used as demonstrations to the farmers of the methods of overwintering of this insect. Thirty-eight meetings were held throughout the cotton belt, while three speaking teams worked all through March, covering every important cotton county in the State. Over 3,000 farmers and others attended these meetings. In the spring campaign the dusting of cotton with calcium arsenate was taken up. About 60 demonstrations of this method of control were put on through county agents. The extension entomologist visited these demonstrations, correcting the dusting machinery and making observations on the effects of the treatment. It is estimated that 50 per cent of the cotton farmers are now familiar with the improved cultural methods and will be able to grow cotton in average years in spite of the weevil.

During the winter a survey was made and a campaign put on to destroy hibernating places of the chinch bug. A check over of the territory in the spring showed that there were 95 chinch bugs to the square yard in unburned places and only 5 bugs to the square yard on burned farms. This work was so successful that many of the farmers this

fall are going ahead with the work without outside stimulus. Where the burning was not completely done last winter serious damage was avoided by plowing a furrow between the grain supply and row crops.

During the winter months we were warned of the green-bug situation by the Federal green-bug squad that worked south of the Kansas station and north of the Texas station. Under the cooperative plan these reports are immediately forwarded by the Federal Insect Pest Survey to the entomologists in the several States. In January we were informed that the bugs were showing up in northern Texas and were moving toward Oklahoma. Soon after this outbreaks occurred in the northeastern part of Nowata County and soon in the nearby counties, while later in the spring Payne County had a number of seriously infested fields. Burning demonstrations were put on in this work and also demonstrations of dusting with nicotine dust. This latter treatment resulted in the destroying of 95 per cent of the green bugs with no damage to the wheat or to the green-bug parasites. Plowing out of badly infested fields was also demonstrated.

Pennsylvania. - The work was chiefly along the line of circularizing information on the control of insects of unusual abundance and of outbreaks of insects that threatened immediate crop destruction, with the demonstration of insect-control work in relation to its place as a part of the regular farm operations.

The Oriental peach moth caused tremendous loss on young non-bearing fruit trees late in the summer, and still later in the summer the peach fruit was infested. In one county it is estimated that \$30,000 worth of fruit was damaged. Demonstration orchards for fruit-insect control are located in 21 counties and comprise over 40,000 trees. One of the particular problems is the farm orchard. In an orchard in Lawrence County containing 105 trees, of which 80 were bearing, the average annual yield of a 10-year period was 400 bushels, and the average annual income for this period amounted to about \$250. During 1923 the yield from this orchard was increased to 700 bushels with a gross income of \$621.25. The spraying cost amounted to \$152, leaving a net income over the 10-year average of over \$200. The spray ring seems to be producing results in this State. One spraying outfit was placed in a community in the spring of 1920, in 1921 3 additional outfits were purchased, in 1922 the work was extended into 5 other communities where 6 sprayers were operated, and during the present year 7 additional machines were added to the list of machines in operation. During this year 17 power sprayers were operated in 12 communities, 12 of which are standard orchard outfits; these were used in 98 orchards. Comparisons of community returns from spraying indicate that spraying has become a part of the farm operation and that the men are convinced that the old orchard is a paying proposition. In 1923, 5 associations harvested 22,000 bushels of apples which gave a net return of 13,900 apples; in 1922 the same men harvested 22,000 bushels which are being sold on an average of 5 cents a bushel more than last year.

Forty-seven demonstrations in peach-borer control were put on covering 18 counties. As a result, over 440 peach growers treated their orchards. In 1921 for each demonstration conducted there were 1,628 trees treated; the following season for each demonstration there were 3,128 trees treated; during the present year there were 6,655 trees treated for each demonstration given.

In the Erie County grape section a vineyard spraying service is maintained. This service is a result of the request of 550 growers for information. The forecasting is made from records on the demonstration vineyards. The forecast of the spraying period involved an estimated knowledge of the development of the insect and the quite accurate information as to the time of greatest abundance of the particular instar.

The most important grain-crop pest in Pennsylvania is the Angoumois grain moth, the most severe damage being in the 25 counties in the southeastern section of the State, which produce over two-thirds of the wheat raised in the State. The extension entomologist believes that the change of farm practice for the control of this insect is more generally explained and more rapidly adopted than any other pest of entomological farm management work that has come to his attention. The practice adopted consisted largely of early threshing for the control of the pest. As a result of this work, over 60 per cent of the wheat was threshed before September 1, which is considered as the safe date for threshing. Proper housing of wheat and control of the insect by the use of carbon disulphide were also demonstrated. Demonstrations in control by the use of disulphide are decreasing very rapidly, as the farmers in the counties are becoming familiar with this method of control.

Permanent regional demonstrations are located in representative sections of the State where careful records of the emergence and egg laying of the Hessian fly are kept. These are used as a basis for determining the fly-free date from year to year.

South Dakota. The work in this State is a combination of entomology and horticulture, one specialist being employed for both lines of work, even including landscape gardening. The entomological work was very largely of an emergency nature. The chinch bug was the outstanding insect pest in the spring of 1923, nine counties being infested and three suffering notable damage. Grasshopper work was carried on in the Black Hills region. In the chinch-bug work 10 meetings were held and 18 demonstrations on protecting corn from chinch bugs by barriers were put on. During the early winter mass meetings were held in 2 counties to urge the farmers to burn the hibernating places of this insect. In 1 county the work was done very largely by school children. As a result of this work, it is estimated that over 200 miles of fence rows and roadsides were burned in one county alone and the chinch-bug damage was noticeably lighter in communities where burning was systematically carried out. Five demonstrations on mixing applications of poisoned bran mash for the control of grasshoppers were conducted. An early spring survey of the grasshopper situation made it possible to locate the region where work was to be carried on later in the season.

The outlook for extension work in entomology is most encouraging. The work is of such a nature as to lend itself readily to demonstration, and the results are usually of so striking a nature as to strongly impress those for whom the demonstration is prepared.

From its inception under the emergency legislation caused by the great war, extension work in entomology has steadily grown. The work is now a permanent part of the extension organization in many States. As the pressure of work along entomological lines interferes with the research work of the agricultural experiment stations, State after State will find it necessary to employ extension entomologists.